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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Chen et al.	§	Attorney Docket No. 28787.3
	§	
	§	Customer No. 27683
Serial No. 09/675,628	§	
	§	Group Art Unit: 2151
Filed: September 29, 2000	§	
	§	Examiner: Bautista, Xiomara L.
For: INTERACTIVE TOPOLOGY GRAPHS FOR VISUALIZATION AND CHARACTERIZATION OF SONET CONSUMPTION PATTERS	§	

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Mail Stop Appeal Brief - Patents
Commissioner of Patents
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2. Check in the amount of $330.00;
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4. Return postcard.

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Respectfully submitted,

David M. O'Dell
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Dated: 10-25-04

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APP/2151

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BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents
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This Brief is submitted in connection with an appeal from the final rejection by the Examiner dated February 24, 2004, finally rejecting all of the pending claims 1-28.

REAL PARTY IN INTEREST

The real party in interest is SBC Technology Resources, Inc., a Delaware corporation having a principal office and place of business at 9505 Arboretum Blvd., Austin, Texas.

RELATED APPEALS AND INTERFERENCES

There are no related appeals and no related interferences regarding the above-identified patent application.

STATUS OF CLAIMS

Claims 1-28 are pending, stand finally rejected, and are on appeal here. Claims 1-28 are set forth in Claims Appendix attached hereto.

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STATUS OF AMENDMENTS

No amendment was filed following the final rejection dated February 24, 2004.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention, as now set forth in independent claim 1, relates to a method for visualizing at least a portion of a synchronized optical network (SONET) ring (Fig. 3; page 5, lines 17-19; Fig. 6; page 10, lines 2-4). The method includes instructions for providing one or more menus from which a user may specify specific components of the SONET ring (Fig. 6; page 10, lines 4-5; Fig. 7; page 10, lines 14-16;); calculating and drawing a graphical representation of the SONET ring illustrating each node and link of the SONET ring specified by the user (Fig. 6; page 10, lines 5-7); receiving a user selection for identifying one node of the SONET ring (Fig. 6; page 10, lines 7-8); accessing an inventory system for data related to the user selection (Fig. 6; page 10, lines 8-9); and displaying more detailed information about the selected node wherein the link comprises a time slot (Fig. 3; Fig. 6; page 10, lines 9-10).

Note: Means plus functions included in Claim 12 are highlighted below.

The present invention, as now set forth in independent claim 12, relates to a monitoring system for providing interactive topology information about a ring-type network (Figs. 1-2; page 5, lines 15-19). The monitoring system includes an inventory system connected to the ring-type network for collecting status data from the ring-type network in a raw format (Fig. 2; page 4, lines 21-24). The monitoring system further includes a computer system capable of retrieving raw format status data from the inventory system (Fig. 2; page 4, lines 19-24), and further includes **means for providing one or more menus from which a user may specify specific components of the ring-type network** (Fig. 6; page 10, lines 2 and 4-5); **means for calculating and drawing a graphical representation of the ring-type network illustrating each node and link of the ring-type network specified by the user** (Fig. 6; page 10, lines 2 and 5-7); **means for receiving a user selection for identifying one component of the ring-type network** (Fig. 6; page 10, lines 2 and 7-8); **means for displaying specific information by placing a cursor on a specific area** (Fig. 3; page 4, line 21; page 7, lines 4-7; page 10, line 2); and **means for displaying more detailed information about the selected component** (Fig. 3; page 7, lines 4-7; page 10, lines 2 and 9-10).

The present invention, as now set forth in independent claim 26, relates to a monitoring system for providing interactive topology information about a ring-type network (Figs. 1-2; page 5, lines 15-17). The monitoring system includes an inventory system for providing data about a logical ring-type network and for collecting status data from the ring-type network in a raw format (Figs. 2-3; page 4, lines 21-24). The monitoring system further includes a computer system that includes a system interface capable of retrieving raw format status data from the inventory system and a graphical user interface for providing one or more menus from which a user may specify specific components of the ring-type network (Figs. 2-3; page 4, line 20 to page 5, line 4); for calculating and drawing a graphical representation of the ring-type network illustrating each node and link of the ring-type network specified by the user (Fig. 2; page 4, lines 19-20; Fig. 6; page 10, lines 2-3 and 5-7); for receiving a user selection for identifying one component of the ring-type network and for displaying more detailed information about the selected component (Fig. 2; page 4, lines 19-20; Fig. 6; page 10, lines 2-3 and 7-10).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,910,809 to Grau et al. ("Grau") in view of U.S. Patent No. 5,621,383 to Yoshiyama ("Yoshiyama"), U.S. Patent No. 6,163,544 to Andersson ("Andersson"), U.S. Patent No. 6,594,696 to Walker("Walker"), U.S. Patent No. 6,295,540 B1 to Sanschagrin ("Sanschagrin"), the article entitled "Sonet Management," the article entitled "Fluke Networks SwitchWizard," the article entitled "SLA Enforcement Tools to the Rescue, Visual Uptime Wins Blue Ribbon Award for Accuracy and Reporting Features," and the article entitled "Predicting Failure."

ARGUMENT

INDEPENDENT CLAIMS

I. The Independent Claims Are Not Taught Or Suggested By Grau In View Of Yoshiyama, Andersson And Walker.

Claims 1, 12 and 26 stand rejected as being obvious under 35 U.S.C. §103(a) in light of Grau in view of Yoshiyama, and Andersson/Walker. It is well settled that in order to reject a patent application for obviousness, the prior art references must teach or suggest all of the claim limitations. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Moreover, all words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Accordingly, even if properly combinable, the references must disclose all of the limitations of claims 1, 12 and 26, and all of the words in the claims must be considered when judging their patentability.

It is clear that the references fail to teach or suggest claims 1, 12 and 26 as required by MPEP § 2143.

A. Independent Claim 1 Is Not Taught Or Suggested By Grau In View Of Yoshiyama And Andersson.

Independent claim 1 is not taught by Grau in view of Yoshiyama and Andersson for three independent reasons as set for the below.

1. user-specific components

Claim 1 recites in part: "providing one or more menus from which a user may specify specific components of the SONET ring [and] calculating and drawing a graphical representation of the SONET ring illustrating each node and link of the SONET ring specified by the user." (emphasis added). Because the graphical representation of the SONET ring is calculated and drawn based on the user-specified components, the graphical representation is user-specific.

In contrast, Grau teaches assembling the network components into a plurality of "atlas maps", and a user can use his/her browser to "easily switch between maps of interest." (Grau, col. 7, lines 49-57). Therefore Grau does not teach calculating and drawing a graphical representation of the SONET ring specified by the user.

Therefore, for this independent reason, claim 1 should be allowed over the cited references.

2. graphical representation

Claim 1 recites in part: "calculating and drawing a graphical representation of the SONET ring illustrating each node and link of the SONET ring specified by the user." (emphasis added). Thus the SONET ring is graphically drawn and each node and link specified by the user is illustrated in the graphical representation.

In contrast, Grau teaches that each node is represented in the atlas maps, and the "logical relationships" between the nodes are further represented. It is important to understand this in light of the problem being addressed by Grau. Characterizing the prior art, Grau states that "the layout of the internetwork is such that nodes typically appear far away from their neighboring nodes, making it hard to discern relationships among element in the system." (Grau, col. 1, lines 49-52). Grau addresses this problem by having the nodes grouped into browser pages, with the "relationships" between the nodes represented logically on each page. (Grau, col. 1, lines 63-67).

Even though Grau teaches separating the internetwork into a plurality of pages, Grau never teaches or suggests drawing a graphical representation of a network using a subset of the nodes, as is required in claim 1 (including the nodes specified by the user).

Therefore, for this independent reason, claim 1 should be allowed over the cited references.

3. time slot

Claim 1 recites in part: "calculating and drawing a graphical representation of the SONET ring illustrating each node and link of the SONET ring specified by the user; . . . displaying more detailed information about the selected node wherein the link comprises a time slot." (emphasis added).

The Examiner conceded that neither Grau nor Yoshiyama teaches a link consisting of a time slot, and instead relied on Andersson. However, the cited text of Andersson recites the following:

In FIG. 5 there is shown a physical layer 31 and a logical layer 32. The resources of the

physical network, such as switches, trunks, links and time slots in links, auxiliary devices, are shared among a number of logical networks. Each logical network is operated by an operator. There may be different operators for different logical networks. A logical network is a picture of the portions of the physical network allocated to the individual logical network. " (col. 7, lines 25-32) (emphasis added)

Therefore, contrary to claim 1, which recites displaying a time slot, Andersson only references the existence of the time slots, but not the display of the time slots.

Therefore, for this independent reason, claim 1 should be allowed over the cited references.

B. Independent Claim 12 Is Not Taught Or Suggested By Grau In View Of Yoshiyama And Walker.

Independent claim 12 is not taught by Grau in view of Yoshiyama and Walker for reasons similar to those discussed above with reference to claim 1.

Claim 12 requires, inter alia, "a computer system capable of retrieving raw format status data from the inventory system, and further including: means for providing one or more menus from which a user may specify specific components of the ring-type network [and] means for calculating and drawing a graphical representation of the ring-type network illustrating each node and link of the ring-type network specified by the user.

For the same reasons as discussed above with reference to claim 1, neither Gau nor the other cited reference teach or suggest this novel feature.

Therefore, for this independent reason, claim 12 should be allowed over the cited references.

C. Independent Claim 26 Is Not Taught Or Suggested By Grau In View Of Yoshiyama.

Independent claim 26 is not taught by Grau in view of Yoshiyama since neither reference teaches or suggests a logical network.

Claim 26 recites in part: "an inventory system for providing data about a logical ring-type network and for collecting status data from the ring-type network in a raw format[.]" (emphasis added).

In contrast, the combination of Grau and Yoshiyama teaches a physical network. For example, Grau discloses "[e]ach map of the atlas depicts a portion or page of the internetwork system, with a top-level page illustrating the overall WAN structure of the system and subordinate-level pages showing the structures of specific campuses, i.e., LAN-connected areas of the system." (col. 2, lines 42-47) (emphasis added)

Further, the combination of Grau and Yoshiyama discloses logical relationships in a physical network. For example, the cited text of Grau recites the following:

> A management console interacts with the server to provide a graphical user interface for displaying the atlas on a computer screen in a variety of views that facilitate comprehension of logical relationships between various components of the system. (col. 1, lines 63-67) (emphasis added)

In that regard, Applicant respectfully directs the Examiner's attention to the selected section of the Microsoft Computer Dictionary (attached hereto under Evidence Appendix), which recites that "physical network . . . does not necessarily resemble the logic network . . . ." (emphasis added)

Therefore, since Gau recites logic relationships in a physical network, it fails to disclose a logical network, as required by claim 26.

Since neither of the references teaches or suggests the above claimed elements, it is impossible to render the subject matter of claim 26 as a whole obvious, and the explicit terms of the statute cannot be met. Accordingly, the rejection of claim 26 under 35 U.S.C. § 103 should be withdrawn, and claim 26 should be allowed.

II. Combination Of Grau, Yoshiyama, And Andersson/Walker Is Improper.

Regarding claim 1 and the combination of Grau, Yoshiyama, and Andersson, the Examiner has asserted that "it would have been obvious to one having ordinary skill in the art to modify Grau's network atlas mapping tool to include Yoshiyama's ring network because it allows a user to design a ring network having graphical representations of nodes, links, and other elements connected to the network, to monitor the network, collect, and provide information about the condition of every device." (page 4, second paragraph of the Final Office Action dated

February 24, 2004). Further, the Examiner has asserted that "it would have been obvious to an artisan in the art at the time of invention to modify Grau/Yoshiyama's network system to include Andersson's teaching of links having time slots because users can determine the capacity of a switch or transmission channel by figuring how many slots are present." (page 5, first paragraph of the Final Office Action dated February 24, 2004).

Regarding claim 12 and the combination of Grau, Yoshiyama and Walker, the Examiner has asserted that "it would have been obvious to a person having ordinary skill in the art at the time of invention to modify Grau/Yoshiyama's network system to include Walker's technique of displaying detailed information because the additional information can be displayed only when the user needs it and it is an easy, quick, and convenient way of retrieving data for determining factors about the operation and/or state of the network." (page 9, last paragraph to page 10, first paragraph of the Final Office Action dated February 24, 2004).

Regarding claim 26 and the combination of Grau and Yoshiyama, the Examiner has asserted that "it would have been obvious to one having ordinary skill in the art to modify Grau's network atlas mapping tool to include Yoshiyama's ring network because it allows a user to design a ring network having graphical representations of nodes, links, and other elements connected to the network, to monitor the network, collect, and provide information about the condition of every device." (page 4, second paragraph of the Final Office Action dated February 24, 2004).

It is respectfully submitted that the combination of Grau, Yoshiyama, and Andersson/Walker is improper.

The combination of Grau and Yoshiyama is especially improper with respect to claim 1, which recites the element of a SONET ring. Since Grau is directed toward organizing and displaying an entire computing system, it is improper to modify Grau to include Yoshiyama's SONET ring, as Grau's method of mapping an entire system is impractical for a SONET ring, which contains overwhelming amount of information. For a SONET ring, a practical solution (as proposed by the present application) is to present selected components (as opposed to the entire system).

First, according to MPEP § 2143.01, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention when some teaching, suggestion, or motivation to do so is found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

Here, there is no teaching, suggestion, or motivation to support the combination of Grau, Yoshiyama, and Andersson/Walker.

Second, it is clear that there must be evidence that a skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. It is also clear that a rejection cannot be predicated on the mere identification of individual components of claimed limitations. Rather, **particular findings** must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed. *Ecolochem Inc. v. Southern California Edison,* 56 USPQ2d 1065, 1076 (Fed. Cir. 2000) (emphasis added)

However, the Examiner failed to present any particular findings.

Third, the best defence against hindsight-based obviousness analysis is the rigorous application of the requirement for a showing of a teaching or motivation to combine the prior art references. See *In re Dembiczak*, 50 USPQ2d, 1614, 1617 (Fed. Cir. 1999). "Combining prior art references without ***evidence*** of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability – the essence of hindsight." *Id.* (emphasis added)

It is respectfully submitted that the only way Grau, Yoshiyama, and Andersson/Walker could be combined together to defeat patentability of the application is to take Applicants' disclosure as a blueprint. Therefore, the combination of references is improper.

Fourth, *In re Dembiczak*, 50 USPQ 2d 1614, 1616-17 (Fed. Cir. 1999), the Federal

Circuit held:

> Our analysis begins in the text of section 103 quoted above, with the phrase "at the time the invention was made." In this case, the Board fell into the hindsight trap. . . . The range of sources available, however, ***does not diminish the requirement for actual evidence. That is, the showing must be clear and particular.*** *(emphasis added)*

Here, the Examiner failed to present clear and particular evidence. Perfunctory assertions by the Examiner (listed above) are not clear and particular "evidence" demanded by the Federal Circuit. Thus, the Examiner failed to make a prima facie case for obviousness.

Accordingly, Applicants respectfully submit that the combination of Grau, Yoshiyama, and Andersson/Walker is improper.

Therefore, for this reason alone, claims 1, 12 and 26 are allowable over the cited references.

DEPENDENT CLAIMS

Dependent claims 2-11, 13-25 and 27-28 depend from and further limit respective independent claims 1, 12 and 26, and should also be allowed.

III. Conclusion

Accordingly, it is respectfully submitted that none of the cited references teaches or suggests the subject matter of claims 1-28. Moreover, it is respectfully submitted that it is improper to combine the references because there is no motivation or suggestion for such combination to achieve the Applicants' claimed elements.

For all of the foregoing reasons, it is respectfully submitted that claims 1-28 be allowed. A prompt notice to that effect is earnestly solicited.

Respectfully submitted,

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Bonnie Boyle

CLAIMS APPENDIX

1. A method for visualizing at least a portion of a synchronized optical network (SONET) ring, the method comprising instructions for:

providing one or more menus from which a user may specify specific components of the SONET ring;

calculating and drawing a graphical representation of the SONET ring illustrating each node and link of the SONET ring specified by the user;

receiving a user selection for identifying one node of the SONET ring;

accessing an inventory system for data related to the user selection; and

displaying more detailed information about the selected node wherein the link comprises a time slot.

2. The method of claim 1 wherein the more detailed information includes individual information about any links connected to the selected node.

3. The method of claim 1 wherein the more detailed information includes individual information about any drop ports on the selected node.

4. The method of claim 1 wherein the instructions for calculating and drawing a graphical representation of the SONET ring include:

determining a percent consumed and a percent spare capacity for each node and graphically displaying the percentages with the graphical representation of the node.

5. The method of claim 4 wherein the instructions for calculating and drawing a graphical representation of the SONET ring further include:

determining a percent restricted and a percent pending for each node and graphically displaying the percentages with the graphical representation of the node.

6. The method of claim 1 wherein the instructions for calculating and drawing a graphical representation of the SONET ring include:

determining a consumed or spare status for each link and graphically displaying the status

with the graphical representation of the link.

7. The method of claim 1 wherein the instructions for calculating and drawing a graphical representation of the SONET ring include:

determining a utilized drop port for each node and link connection and graphically displaying the utilized drop port with the graphical representation of the node.

8. The method of claim 1 wherein the instructions for calculating and drawing a graphical representation of the SONET ring include:

determining whether each node serves as a hub and graphically displaying a hub designation with the graphical representation of the corresponding node.

9. The method of claim 1 wherein user selection for the node is a default selection.

10. The method of claim 1 further comprising instructions for:

receiving a user selection for identifying one link of the SONET ring; and

displaying more detailed information about the identified link.

11. The method of claim 1 wherein the more detailed information about the identified link includes a consumption status.

12. A monitoring system for providing interactive topology information about a ring-type network, the monitoring system comprising:

an inventory system connected to the ring-type network for collecting status data from the ring-type network in a raw format; and

a computer system capable of retrieving raw format status data from the inventory system, and further including:

means for providing one or more menus from which a user may specify specific components of the ring-type network;

means for calculating and drawing a graphical representation of the ring-type network illustrating each node and link of the ring-type network specified by the user;

means for receiving a user selection for identifying one component of the ring-type network;

means for displaying specific information by placing a cursor on a specific area; and

means for displaying more detailed information about he selected component.

13. The monitoring system of claim 12 wherein the more detailed information about the selected component includes a consumption status.

14. The monitoring system of claim 12 wherein the selected component is a node of the ring-type network.

15. The monitoring system of claim 14 wherein the more detailed information includes individual information about any links connected to the selected node and individual information about any drop ports on the selected node.

16. The monitoring system of claim 14 wherein the means for calculating and drawing a graphical representation of the ring-type network includes:

computer instructions for determining a percent consumed and a percent spare capacity for each node and graphically displaying the percentages with the graphical representation of the node.

17. The monitoring system of claim 14 wherein the means for calculating and drawing a graphical representation of the ring-type network further includes:

computer instructions for determining a percent restricted and a percent pending for each node and graphically displaying the percentages with the graphical representation of the node.

18. The monitoring system of claim 14 wherein the means for calculating and drawing a graphical representation of the ring-type network includes:

computer instructions for determining a consumed or spare status for each link and graphically displaying the status with the graphical representation of the link.

19. The monitoring system of claim 14 wherein the means for calculating and drawing a graphical representation of the ring-type network includes:

computer instructions for determining a utilized drop port for each node and link connection and graphically displaying the utilized drop port with the graphical representation of the node.

20. The monitoring system of claim 14 wherein the means for calculating and drawing a graphical representation of the ring-type network includes:

computer instructions for determining whether each node serves as a hub and graphically displaying a hub designation with the graphical representation of the corresponding node.

21. The monitoring system of claim 12 wherein the ring-type network is a synchronized optical network, and the inventory system is a trunks integrated record keeping system.

22. The monitoring system of claim 14 wherein the more detailed information includes a mismatch identifier about any links that are inventoried differently by connecting nodes.

23. The monitoring system of claim 14 wherein the more detailed information includes an indicator that service is dropping at a specific node.

24. The monitoring system of claim 12 wherein the more detailed information identifies bandwidth usage between two nodes.

25. The monitoring system of claim 12 wherein the more detailed information identifies drop ports connected to a specific link.

26. A monitoring system for providing interactive topology information about a ring-type network, the monitoring system comprising:

an inventory system for providing data about a logical ring-type network and for collecting status data from the ring-type network in a raw format; and

a computer system including a system interface capable of retrieving raw format status data from the inventory system and a graphical user interface for providing one or more menus from which a user may specify specific components of the ring-type network, for calculating and drawing a graphical representation of the ring-type network illustrating each node and link of the ring-type network specified by the user, for receiving a user selection for identifying one component of the ring-type network and for displaying more detailed information about the selected component.

27. The monitoring system of claim 26 wherein the more detailed information about the selected component includes a consumption status.

28. The monitoring system of claim 26 wherein the selected component is a node of the ring-type network.

EVIDENCE APPENDIX

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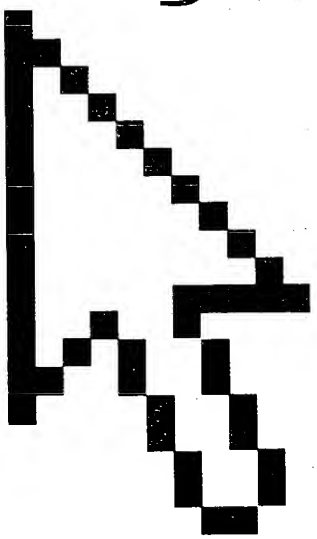

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log files *n.* A computer file that records requests received by online applications or the number of hits a Web page receives. Log files are useful in analyzing the technical performance of a Web site, redesigning Web site navigation, and revising marketing strategies used by e-businesses.

logic *n.* In programming, the assertions, assumptions, and operations that define what a given program does. Defining the logic of a program is often the first step in developing the program's source code. *See also* formal logic.

logical *adj.* **1.** Based on true and false alternatives as opposed to arithmetic calculation of numeric values. For example, a logical expression is one that, when evaluated, has a single outcome, either true or false. *See also* Boolean algebra. *Compare* fuzzy logic. **2.** Conceptually true to a particular design or idea—for example, network transmissions travel in a circle around a logical ring, even though the ring shape itself is not physically apparent. *Compare* physical.

logical block addressing *n.* A technique in which the cylinder, head, and sector locations on a hard disk are converted to 24-bit addresses for data storage and retrieval. Logical block addressing is used with SCSI drives and is also a feature of Enhanced IDE (EIDE) disk drives, on which it breaks through the earlier 528-MB IDE limit and allows support for drives up to 8.4 GB in capacity if 24-bit logical address space is used. Address conversion is performed by an EIDE drive's disk controller, but also requires support from the BIOS and the computer's operating system. *Acronym:* LBA. *See also* EIDE, SCSI.

logical decision *n.* Any decision that can have one of two outcomes (true/false, yes/no, and so on). *Compare* fuzzy logic.

logical device *n.* A device named by the logic of a software system, regardless of its physical relationship to the system. For example, a single floppy disk drive can simultaneously be, to the MS-DOS operating system, both logical drive A and drive B.

logical drive *n. See* logical device.

logical error *n. See* logic error.

logical expression *n. See* Boolean expression.

logical file *n.* A file as seen from a conceptual standpoint, without reference to and as distinct from its physical realization in memory or storage. For example, a logical file might consist of a contiguous series of records, whereas the file might be physically stored in small pieces scattered over the surface of a disk or even on several disks. A logical file might also consist of some subset of columns (fields) and rows (records) extracted from a database. In this case, the logical file (or view) is only that information required by a particular application program or user.

Logical Link Control *n. See* LLC.

logical memory *n.* A correlation between physical memory of the computer system and an address range that is accessible to devices. The hardware abstraction layer (HAL) provides this correlation (or mapping). *See also* map.

logical network *n.* A way to describe the topology, or layout, of a computer network. Referring to a logical (rather than physical) topology describes the way information moves through the network—for example, in a straight line (bus topology) or in a circle (ring topology). The difference between describing a network as logical or physical is sometimes subtle because the physical network (the actual layout of hardware and cabling) doesn't necessarily resemble the logical network (the path followed by transmissions). A logical ring, for example, might include groups of computers cabled octopus-like to hardware "collection points" which, in turn, are cabled to one another. In such a network, even though the physical layout of computers and connecting hardware might not visually resemble a ring, the logical layout followed by network transmissions would, indeed, be circular. *See also* bus network, ring network, star network, token ring network, topology. *Compare* physical network.

logical operator *n.* An operator that manipulates binary values at the bit level. In some programming languages, logical operators are identical to Boolean operators, which manipulate true and false values. *See also* Boolean operator, mask.

logical record *n.* Any unit of information that can be handled by an application program. A logical record can be a collection of distinct fields or columns from a database file or a single line in a text file. *See also* logical file.

logical schema *n. See* conceptual schema.

logic analyzer *n.* A hardware device that facilitates sophisticated low-level debugging of programs. Typical features include the ability to monitor bus signals during execution, to halt execution when a given memory location is read or written to, and to trace back through some number of instructions when execution is halted for any reason. *See also* debugger.

RELATED PROCEEDINGS APPENDIX

None.